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The Sky: Spring and Summer Nights

NATURE STUDY

THE SKY: SPRING AND SUMMER NIGHTS

BY

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To
ALL WHO ARE ENLISTED
UNDER THE SIGN OF VIRGO

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man."

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*And hers shall be the breathing balm,
And hers the silence and the calm
Of mute insensate things.*

*The stars of midnight shall be dear
To her; and she shall lean her ear
In many a secret place
Where rivulets dance their wayward round,
And beauty born of murmuring sound
Shall pass into her face.*

—WORDSWORTH.

And if there be “no time” in our hurried and busy generation for a sense of the mystery and order of the stars, is not this itself one of the reasons why we should take time for them, and for the healing power of those silences to which they league their unceasing invitations? Our life, just now, is not too rich in imagination, nor too deeply moved by the sense of reverence or the touch of wonder.

—MCKREADY: “A Beginner’s Star-Book.”

SECTION I

A WORD FIRST

"Make Friendship with the Stars"

The mild evenings of spring tempt us to linger out of doors after sunset, and when the warm nights of summer have come, fortunate is the person who can make the sky his roof for the season. This pamphlet is written for those who want the satisfaction of recognizing the stars such evenings, and the joy of understanding their behavior throughout spring and summer. If one determines to learn something of the sky every clear night, it is surprising how much he will know by the end of the summer and how much more worth while such knowledge will make the season.

In the maps included in this pamphlet, only the bright stars and the more conspicuous star-figures are shown. If you do not know how to find north, read Section XI, first. Hold each map toward the sky, in the direction indicated for the time chosen, flash a light on the map, and then look for a duplicate in the sky. If the hour or month chosen is later than that specified, look further west for the star-figure; if earlier, look further east. When twenty star-figures have been found, you will begin to feel at home in the sky. It is an especial joy after a few cloudy nights, to see again one's friends in the sky, where they have been shining steadfastly beyond the clouds all the time.

As the fall approaches, we soon discover that we are going to lose our summer stars from the evening sky, and although we are glad to welcome the brilliant winter constellations

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in the east, we are a little sad to see our friends of the summer go. But we may enjoy the comforting knowledge that they will all greet us again another summer, and yet another, all our lives through. The stars are not friends of just one year, but life-time friends, that never fail the person who has chosen them for comrades. They are always where we expect to find them.

SECTION II

VIRGO, THE VIRGIN

It is no small part of the charm and interest of the constellations that they announce and prefigure the seasons. Spring, summer, autumn and winter—each has its characteristic stars, which keep step with the year.

When, in an April or May night, the sedate Virgin glows amid her well-ordered stars, like an abbess surrounded by white-veiled nuns, how exquisitely the celestial mood responds to the brooding planet! No one who has not had the experience can imagine, or fully credit, the thrill of pleasure that comes to the lover of the stars with his earliest glimpse of the constellations that announce the morning of the year.

—SERVISS: "Astronomy with the Naked Eye."

"Spring has come!" announces a lover of the birds. "I heard a bluebird this morning." "Yes, spring has come," replies a lover of the stars. "I saw *Spica* in *Virgo* early in the evening."

The stars as well as the birds and the flowers tell the coming of the Spring. As early as the first of March *Spica* rises about nine above the eastern horizon, but it is April before this beautiful bright star is high enough to attract attention in the early evening. There are no bright stars near. Only *Arcturus* in *Boötes* keeps it company in the eastern sky further to the north below the handle of the Big Dipper. The orange color of *Arcturus* is in marked contrast to the silvery whiteness of *Spica*.

These two stars can be seen all summer, each month further to the west at the same hour, traveling together across the sky. By the first of August, *Spica* has nearly

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reached the western horizon at nine, and *Arcturus* is following, higher in the west. *Arcturus* lingers after *Spica* has set, and attracts attention in September after sunset low in the northwest, where it glows with a warm reddish light. When we see *Arcturus* following the sun to rest, we know that the summer has ended.

Spica is in the constellation of *Virgo*, the Virgin. In China it is known as the "Frigid Maiden". The Virgin is drawn as a maiden with folded wings carrying a head of wheat in one hand, where *Spica* is found.* One cannot help feeling an interest in this winged maiden of the sky whose advent above the eastern horizon has been associated with the season of seed-time in many lands in every age. One myth relates that the Virgin once lived on earth and in the Golden Age ruled over men as the Goddess of Justice. But in the ages that followed, men, led by the lure of gold, forgot, Justice and the gods and goddesses left the earth. Justice, however, was among the last to leave, but in the Age of Iron—the terrible Age of War—men were of such changed spirit that even she could no longer endure them.

Justice, loathing that race of men,
Winged her flight to heaven; and fixed
Her station in that region
Where still by night is seen
The Virgin goddess near to bright *Boötes*.
—ARATUS.

Some believe that this Goddess of Justice will yet return to earth, in response to the prayers and labor of many women of many nations, to end the Rule of Iron and reign forever over an obedient happy people.

* See figure on cover.

VIRGO, THE VIRGIN

Spica is preceded by a group of stars which form a large V. With *Spica* this group makes a Y. The hollow formed by a curved line connecting the stars of the V is known as the "Retreat of the Howling Dog." The planet Mars is in the constellation of *Virgo* during April, May, June and July, 1920. It is easily recognized by its red color.



VIRGO, THE VIRGIN.

Look for *Virgo*, between April 1, and August 1.

May 1, 9 p.m. in the southeast.

July 1, 9 p.m. in the southwest.

Chart 1

SECTION III

Boötes, the Herdsman; Corona Borealis, the Northern Crown; Hercules, the Kneeler; Coma Berenices, the Hair of Berenice

As the earth puts on its earliest verdure the mild light of *Virgo* appears in the east, and silvery *Spica* beams in placid rivalry with the gold-orange radiance of *Arcturus* hanging below the great handle of the Dipper, between the sheen of Berenice's Hair and the linked pearls of the Northern Crown.

--SERVISS: "Astronomy with the Naked Eye."

It is still winter when *Arcturus* rising at ten the first of February suggests the Spring a month before *Spica* has really announced its coming. Throughout May, *Arcturus* is high in the east in the early evening, and leads the procession of spring and summer stars across the sky. In the fall, it is conspicuous in the northwest, after sunset. It is always easily found by following the curving handle of the Big Dipper. It forms a conspicuous kite-shaped figure with a group of five stars above. *Arcturus* is in the constellation of *Boötes*, the Herdsman, or Bear Driver, who with his Hunting Dogs held by a leash chases the Bears around the Pole.

At the left of *Boötes*, is *Corona Borealis* the Northern Crown, appropriately so-named because it is easy to see the resemblance of its star-figure to a crown. Six faint stars and one bright one form almost a circle. The bright star is the gem of the crown, and the fainter ones, the pearls that adorn it. This group is so startlingly lovely through an opera glass that one exclaims with delight on first discovering it.

Further still to the left is a large butterfly-shaped group in the constellation of *Hercules*. This is a difficult group

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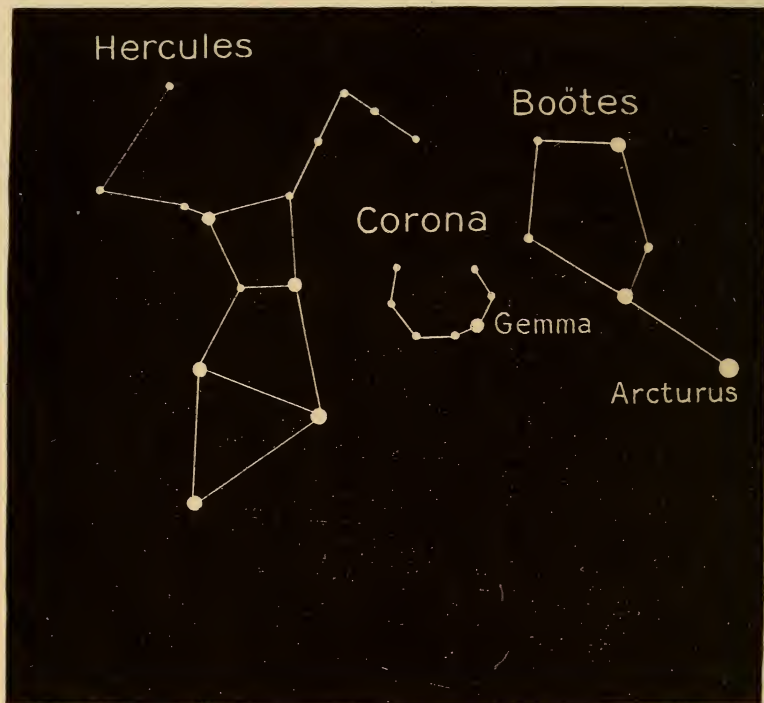
to find, because it contains no very bright stars and no very conspicuous figure, but we like to identify the constellation that bears the name of such a famous character. *Hercules* stands on his head in our sky with one foot on the head of the Dragon. One star marks the head, two the shoulders (the butterfly's left wing), two the belt (the body of the butterfly), and two crooked lines of stars his bent knees. From his posture he has been called "The Man upon his Knees."

On the other side of *Boötes* from *Corona Borealis*, is one of the surprises of the sky. It is easily seen without an opera glass, a bit of cloud apparently, caught and fixed among the stars. But with an opera glass, the "cloud" spreads into a beautiful web, spangled with stars. This star-cluster is in the constellation *Coma Berenices* or Berenice's Hair. To find it, start with the Big Dipper, and instead of following the curving row of stars in the handle to *Arcturus*, turn a sharp corner towards *Virgo*. The map shows its position in relation to *Spica*, *Arcturus* and *Regulus*. It is especially conspicuous when there is no moonlight to dim its pale luster.

There is a story dating from the third century B.C. connected with this star-cluster. Berenice was Queen in Egypt. She had sacrificed her hair as a thank-offering for one of her husband's victories. The hair was kept in one of the temples but one day it was found missing. The guardian of the temple, to escape blame, told her that Jove had placed it in the sky, and to prove his statement, he showed her this cluster which has since been known as Berenice's hair. When you look at it, remember the ancient queen who gazed at it

BOÖTES, THE HERDSMAN

so many centuries ago. But you have an advantage over her, for you can see with your glass that it is only a cluster of stars, which is more than ever she knew about it.



BOÖTES, THE HERDSMAN; CORONA, BOREALIS, THE NORTHERN CROWN; HERCULES, THE KNEELER.

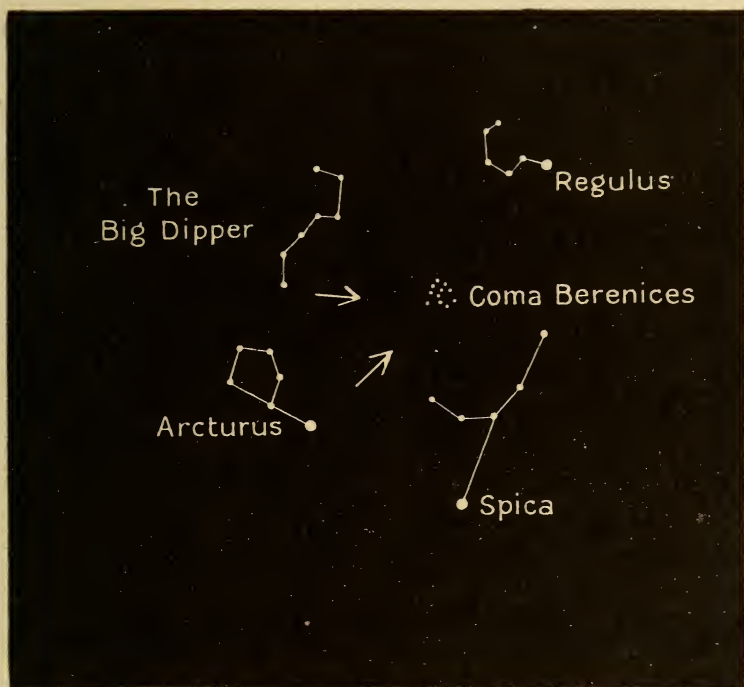
Look for these between April 1 and October 1.

May 1, 9 p.m. *Boötes* high in the east, *Hercules* lower toward the north-east; *Corona* between *Boötes* and *Hercules*.

July 1, 9 p.m. *Corona* and *Hercules* almost overhead; *Boötes* further west.

September 1, 9 p.m. *Boötes* low north of west; *Corona* and *Hercules* higher in the west.

Chart 2



Showing how to find *Coma Berenices* from *Arcturus*,
from *Spica*, or from the Big Dipper.

Chart 3

SECTION IV

LEO, THE LION

In pride the Lion lifts his mane,
To see his British brothers reign
As stars below.

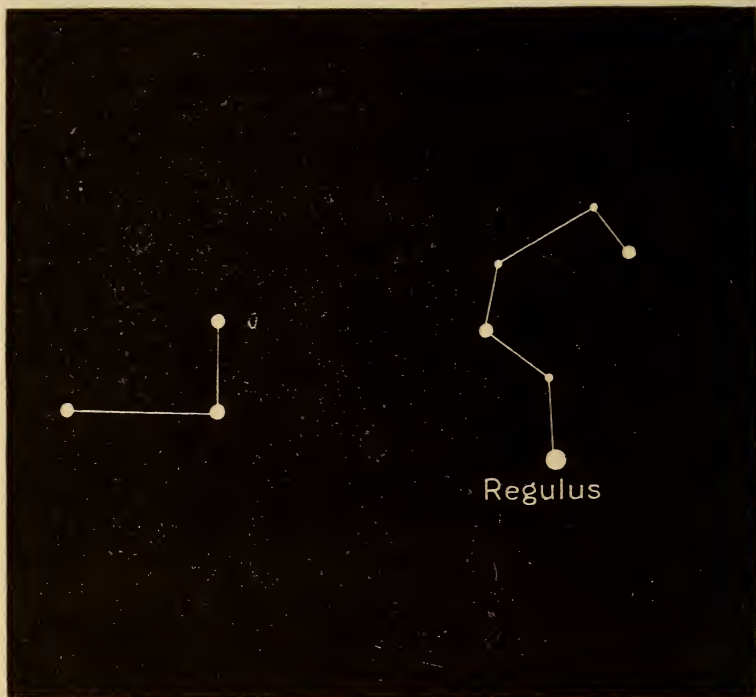
—EDWARD YOUNG.

It is easy to trace the form of a lion in the stars of this constellation. Five stars in a curving row form a group called the Sickle from its shape. A bright star, *Regulus*, is in the handle. The Sickle is in the Lion's head and his tail is indicated by three stars in a right triangle. *Leo* precedes *Virgo*. It is high in the south at 9 p.m. April first, when *Virgo* is just above the eastern horizon. It is seen further west at the same hour in May and June, and is near the western horizon by the first of July. *Regulus* is ranked among the twenty brightest stars, but it is the least bright of the twenty. Still, when there is no moon or bright planet near to dim its light, it proves worthy of its name "The little King".

During the spring and summer of 1920 both Jupiter and Saturn will be in *Leo*. Jupiter, the brighter of the two, at the right of *Regulus* and Saturn at the left. In 1921 both of these planets will be nearer the boundary line between *Leo* and *Virgo*, and by 1922, they will have parted company, Jupiter having advanced into *Virgo*, while Saturn lingers in *Leo* for another summer. When you look at these planets, remember that they are very much nearer us than the stars among which they appear. The stars are only a background

LEO, THE LION

for them. Jupiter's distance from the earth varies approximately from 390 million to 580 million miles, and Saturn's from 774 million to 1,028 million, whereas the nearest star is more than 25 millions of millions of miles away. To make these staggering numbers have more meaning, if you should travel on a beam of light, which goes about 11 million miles in one minute, you could reach Jupiter when it is nearest in a little over half an hour, but it would take you over *four years* to reach the nearest star. Remember, too, that the telescope proves that planets do not manufacture their own light. They are dark bodies, visible to us only because of the sunlight that illumines them. Stars, however, are suns; immense masses of hot material, so hot that it is luminous. Our earth could not be seen from any star, even with telescopes as powerful as the best of ours. Our sun would look like only a dim star when seen from the nearest star, and from many stars it would be quite invisible, for it is not a large star at all, but only of average size or less. The history of the discovery of these facts is a fascinating one, but it must be left for some winter evening when you prefer to read by the fireside instead of watching the sky outside.



LEO, THE LION.

Look for *Leo* between February 1 and July 1.

April 1, 9 p.m. high in the south between *Gemini* and *Virgo*.

June 1, 9 p.m. in the southwest.

July 1, 9 p.m. low in the west.

Chart 4



LEO, THE LION.

Showing how the Sickle forms the head of the Lion.

Chart 5

SECTION V

GEMINI, THE TWINS

And after three months, we departed in a ship of Alexandria, which had wintered in the isle, whose sign was *Castor* and *Pollux*

Acts XXVIII : 11.

Back comes the chief in triumph
Who in the hour of fight
Hath seen the Great Twin Brethren
In harness on his right.
Safe comes the ship to haven
Through billows and through gales,
If once the Great Twin Brethren
Sit shining on the sails.

—MACAULAY: "Lays of Ancient Rome."

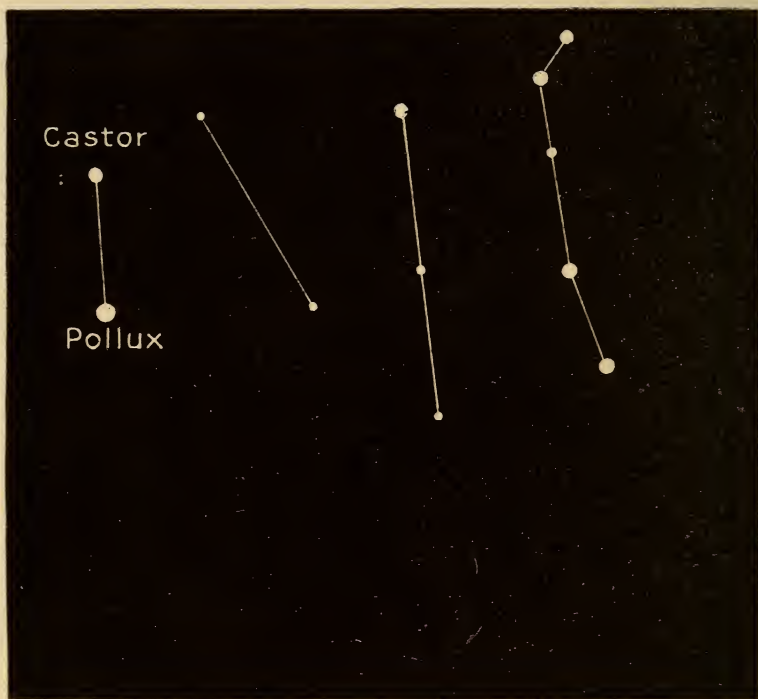
Castor and *Pollux* have always been considered the sailors' stars. It is therefore not strange that the ship that carried Paul away from Malta on his journey to Rome bore the sign of these stars. They seem also to have been the soldiers' stars for they were known in Rome as the "Great White Brethren" who appeared on white horses to give courage in battle.

Castor and *Pollux* are so bright and so near together that it is quite natural that the name *Gemini*, the Twins, should have been given to the constellation containing the two. They are not perfect twins, however, for *Pollux* is a little brighter than *Castor*. Moreover they are not really near each other at all, although apparently side by side in the sky. *Castor* is more than twice as far from us as *Pollux*. If we should travel on a beam of light, eleven million miles every minute, it would take us fifty-one years to reach

GEMINI, THE TWINS

Pollux, and when we arrived, we should find *Castor* far in the distance. We should have to journey sixty-five years more to reach that star, which from the earth seemed so near to its twin.

Castor and *Pollux* are in the heads of the Twins. Rows of faint stars nearly parallel to the line joining *Castor* and *Pollux* mark the knees and the feet. *Gemini* is high in the west in April and is setting in the northwest at nine the first of June.



GEMINI, THE TWINS.

Look for *Gemini* between December 1 and June 1.

January 1, 9 p.m. high in the east.

April 1, 9 p.m. high in the west

June 1, 9 p.m. low in the northwest.

Chart 6

SECTION VI

AURIGA, THE CHARIOTEER

And the shining daffodil dies, and the Charioteer
And starry *Gemini* hang like glorious crowns
Over *Orion's* grave low down in the west.

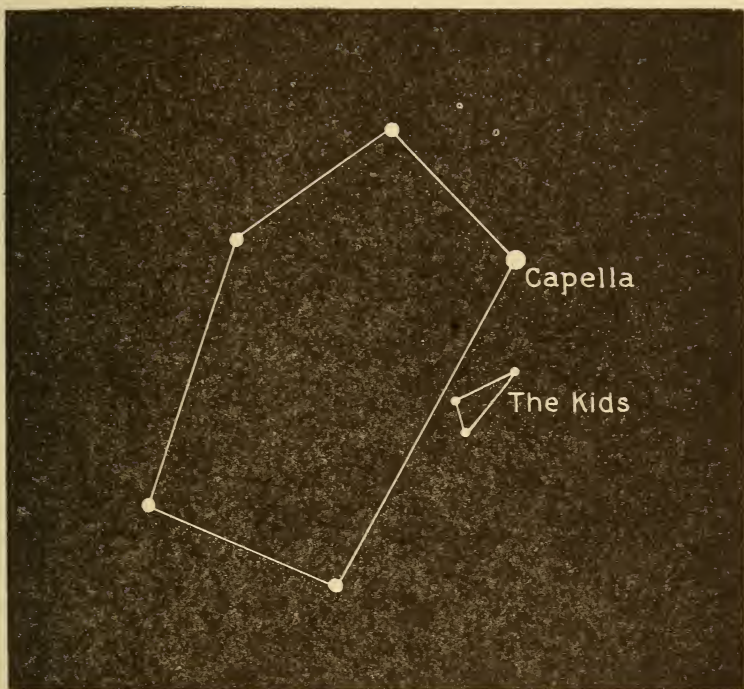
—TENNYSON: "The Princess."

Auriga is one of the last of the winter constellations to disappear from the evening sky. When *Virgo* is in the east, announcing the Spring, *Orion* with the Dogs is going to his grave in the west. By the first of May, only the Charioteer and the starry *Gemini* are left of the glorious constellations that make the winter sky so brilliant. The sky at 9 p.m. in early April before the winter stars have set is the most brilliant of the year. Eleven of the twenty brightest stars can be seen: *Rigel*, *Betelgeuze*, *Aldebaran*, *Sirius* and *Procyon* of the distinctively winter stars are in the west, with *Capella*, *Pollux*, and *Regulus* following, while in the east, *Spica*, *Arcturus* and *Vega*—the stars of spring—are appearing, a wonderful array.

The Charioteer is a man carrying a young goat on his shoulder. The creamy-white star, *Capella*—the Goat Star—is in the heart of the Goat. Near it are three faint stars which form a conspicuous small triangle known as the "kids". *Capella* with four other bright stars forms a large five-sided figure. One star in this group, in the lower left hand corner, is in one of the horns of the Bull. The red eye of the Bull, *Aldebaran*, can still be seen in early April, glowering below *Capella* in the northwest. There are only two stars visible

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in this latitude that are brighter than *Capella*—*Sirius*, the brightest of all stars, a winter star, and *Vega*, a rival of *Capella* in the summer. *Capella* disappears from the evening sky in June but may be greeted again early in September. However, there is not one clear night in the year when it cannot be seen if one is willing to look for it after midnight in July, and late in the evening in August. All through the fall, winter, and spring, its steady light shines in marked contrast to the more scintillating flashes or warmer rays of other brilliant stars. In January, it is overhead at nine, and easily seen and recognized even in cities for there is no other very bright star near it.



AURIGA, THE CHARIOTEER

Look for *Auriga* between October 1 and June 1.

October 1, 9 p.m. low in the northeast.

January 1, 9 p.m. almost overhead.

April 1, 9 p.m. in the northwest.

Chart 7

SECTION VII

SCORPIUS, THE SCORPION

There is nothing more absolutely common to all men than the influence of the stars. No one ever gazed up at them without feeling a change come over his spirit. Truly "they separate between him and what he touches." They free him from the bondage of time and space. There is no trouble that they cannot assuage. And there is no time like the summer for becoming intimate with them. One who has been touched by the magic of their love could lie all the night long on a bed of pine-needles and fill his soul with their beauty. The march of red *Antares* and his glittering retinue across the meridian while the earth sleeps in solstitial calm—who can describe that pageant?

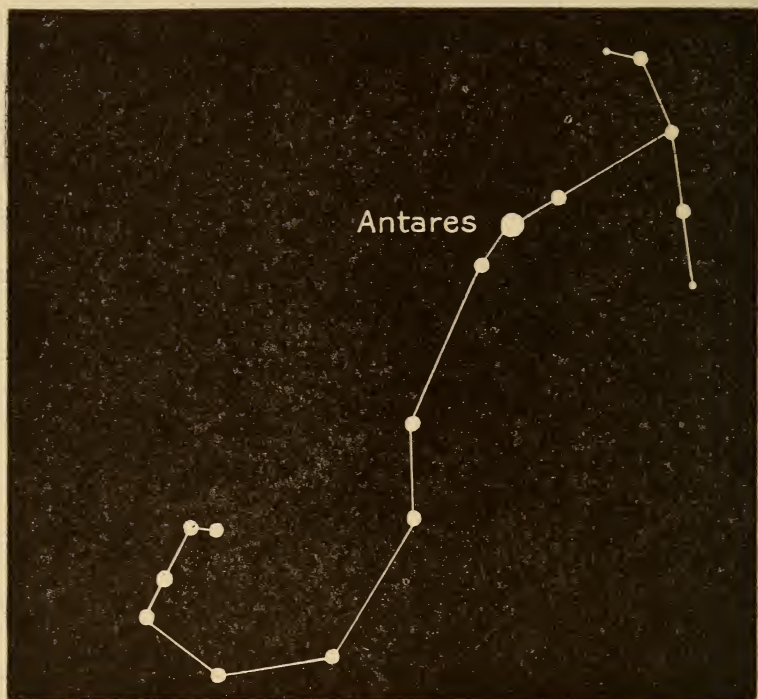
—SERVISS: "Round the Year with the Stars."

Scorpius is as characteristic of summer as *Orion* of winter. The two are never seen in the sky at the same time, quite properly, since it is the Scorpion that stung the heel of *Orion* and caused his death. The Scorpion lifts his head above the southeastern horizon about nine p.m. the first of June and by July his heart, marked by the red *Antares*, is very conspicuous in the south, with the tail trailing eastward just above the horizon. *Antares* is the reddest of the stars visible without a telescope, and the fact that it is also very bright, ranking seventeen in the list of twenty brightest, makes it easy to identify it. The Chinese named it the "Great Fire". The word *Antares* means "like Mars", the red planet.

Antares is a lovely sight through a telescope for it has a small bright green companion. They are like two gems, a large ruby and a small emerald, but there are really no jewels

SCORPIUS, THE SCORPION

equal to the stars in beauty and brilliancy. Since every star is a sun, the inhabitants of planets near *Antares*, if such there are, would have two suns in the sky, one fiery red and the other vivid green. It is hard to imagine what the effect of such contrasted lights on the landscape would be. As a rule, stars that seem close together in the sky are really far apart, but there are many double stars like *Antares* which consist of two suns really close enough to influence each other. Careful observations show that the two are moving about a point between them in accord with the law of gravitation.



SCORPIUS, THE SCORPION.

Look for *Scorpius* between June 1 and September 1.

July 1, 9 p.m. low in the south.

August 1, 9 p.m. low in the southwest.

Chart 8

SECTION VIII

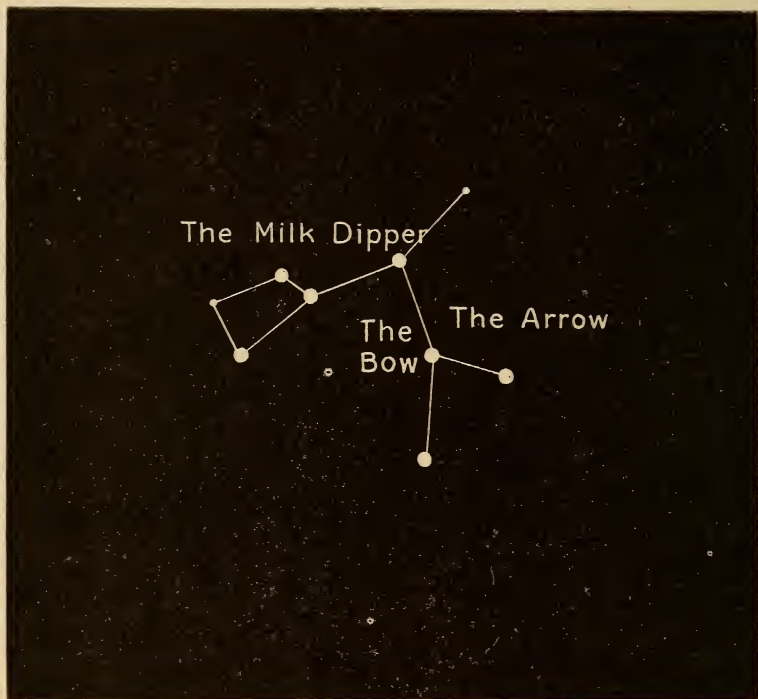
SAGITTARIUS, THE ARCHER

Midst golden stars he stands resplendent now
And thrusts the Scorpion with his bended bow.

—OVID.

It is not until July that the Archer is seen at nine o'clock in the southeast following the Scorpion across the sky. Although it contains no very bright stars, it has a conspicuous group of four which make the body of the Archer, and three which form a distinct bow, with one clearly indicating the arrow aimed at the heart of the Scorpion. The four stars in the body, the top star in the bow, and one star above and to the right of the bow, make a group shaped like a dipper with the bowl opening down. It is called the Milk Dipper to distinguish it from the Big Dipper in the north. This name was suggested from its position near the Milky Way, from which it hangs with the handle in the Milky Way.

The planet Mars will be in this constellation during the spring and summer of 1922.



SAGITTARIUS, THE ARCHER.

Look for *Sagittarius* between July 1 and October 1.

August 1, 9 p.m. low a little east of south.

October 1, 9 p.m. low in the southwest.

Chart 9

SECTION IX

CYGNUS, THE SWAN; AQUILA, THE EAGLE; LYRA, THE LYRE; DELPHINUS, THE DOLPHIN

I guess I'd sooner slog it where there's just a scent of pine,
And over 'ead an 'eap of little stars.
The lights of Charing Cross and Picadilly
I'd swap 'em for the silver of the streams
When the summer moon is lit, and the bats begin to flit
And the dark earth dreams.

—"Goin' Back."

"An 'eap of little stars" accompany these constellations for they are in the Milky Way where stars are thick. *Cygnus* is easily recognized by a group of stars in the shape of a Cross, with one bright one, *Deneb*, at the top. *Lyra* is identified by *Vega*, near the foot of the Cross, the brightest star in the summer sky. Near *Vega* are two faint stars forming a small triangle with *Vega*. Campers like to test their eye-sight on the more northern of the two. It takes a very good eye to see that this star is composed of two. *Aquila* on the other side of the Cross is readily distinguished by a straight line of three stars, the middle one, *Altair*, the brightest. *Vega* is the fourth brightest in the list of twenty brightest stars, being excelled only by two stars not visible north of latitude 37° , and by one winter star, *Sirius*. *Altair* is eleventh in the list, and *Deneb* the nineteenth.

As we look from *Vega* across the Milky Way to *Altair* we realize how true it is that "one star differeth from another in glory". The glory of *Altair* is its scintillating bluish-white light. Because of this blueness and the brilliancy of its

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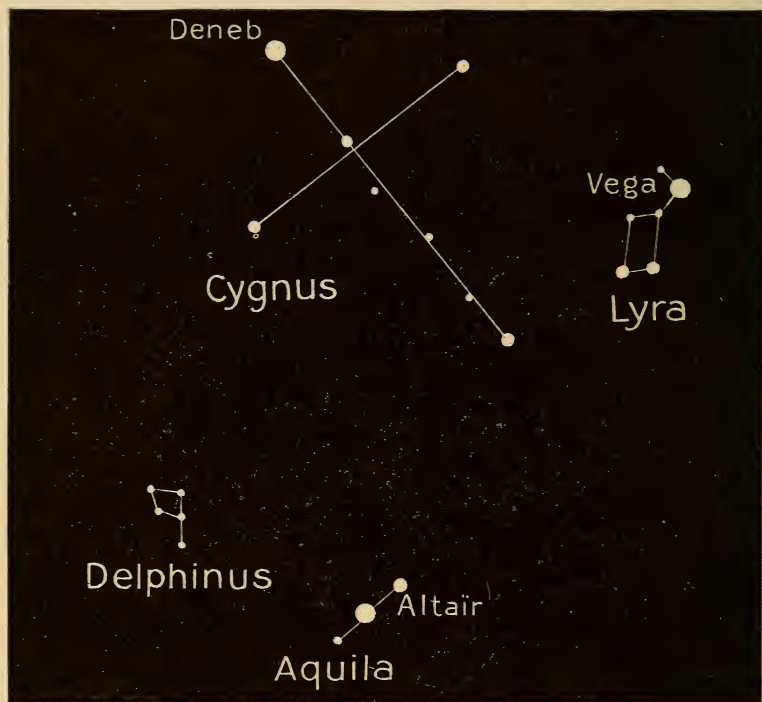
rays, it has been called the "Arc Light of the Sky". The glory of *Altair* on the other hand is its steady yellowish white light. Both these stars are classed as white stars, but it is easy to see a great difference in the quality of their light. This is also true of red stars. There are all shades of red, from the yellowish red or orange of *Aldebaran* to the deep red of *Antares*. No two are alike.

East of *Altair* on the edge of the Milky Way is the little constellation, *Delphinus*, readily identified by a small but remarkably conspicuous group of five faint stars shaped like a diamond with one point prolonged. This group is known as Job's Coffin. It repays observation through an opera glass.

These constellations are in our sky for many months. *Vega* leads, rising at nine April first, followed by the Cross coming up sideways. It is not until July that all are seen in the early evening. The Cross and *Vega* are overhead early in September, at nine o'clock, and *Altair* is high in the South. They hesitate to leave us, lingering in the west long after the winter stars have risen above the eastern horizon. *Vega* and *Altair* are among the stars showing first after sunset in early January, in the northwest. As the sky grows dark, the Cross gleams bright between. It sets lengthwise, still visible after *Vega* and *Altair* have gone.

To see these constellations in all their glory and the Milky Way with its "heap of little stars", to the best advantage, choose a clear night in the late summer or early fall when there is no moonlight to lessen the radiance of the Milky Way. Find some open place where you can see all the sky. Trace the Milky Way from the northeastern horizon, overhead through *Cygnus* where it divides into two streams reach-

ing to the southwestern horizon. Apart from the Milky Way, the sky is black, and the stars few and easily counted, even with an opera glass to show the faint ones. The stars of the Cross gleam undimmed through the soft whiteness of the "River of the Sky". *Vega* is its brightest in the clear black sky, on one side of the Milky Way, and *Altair* gleams quietly just on the edge opposite. In the northwest, *Arcturus* is setting and in the southeast, *Fomalhaut*, the "lone star of the south", is rising. The Northern Crown with its "linked pearls" is still to be seen in the west. Who would not exchange the "lights of Charing Cross and Piccadilly", or of New York, for such a sky?



CYGNUS, THE SWAN; LYRA, THE LYRE; AQUILA, THE EAGLE;
DELPHINUS, THE DOLPHIN.

Look for these between June 1 and December 1.

July 1, 9 p.m. *Lyra* high in the east; *Aquila* directly below; *Cygnus* between and further north; *Delphinus* at the right of *Aquila*.

September 1, 9 p.m. *Cygnus* and *Lyra* almost overhead. *Aquila* and *Delphinus* lower in the south.

November 1, 9 p.m. in the west.

Chart 10

SECTION X

PEGASUS, THE WINGED HORSE; ANDROMEDA, THE CHAINED MAIDEN; PERSEUS, THE CHAMPION

I set thee

High for a star in the heavens, a sign and a hope for the seamen
Spreading thy long white arms all night in the heights of the ether.
Hard by, thy sire and the hero, thy spouse, while near thee thy mother
Sits in her ivory chair, as she plaits ambrosial tresses;
All night long wilt thou shine.

—KINGSLEY: "Andromeda."

Andromeda shines all night in the late summer and fall. There are constellations more beautiful than these but none more romantic. *Andromeda* was the daughter of *Cassiopeia*, Queen of *Æthiopia*. *Cassiopeia* had boasted that she was more beautiful than the sea nymphs, and in revenge, Neptune, the God of the Sea, had sent a monster to ravage the coast. The oracle declared that the only way the kingdom could be saved was by the sacrifice of *Andromeda* to the sea monster. So she was chained to a rock to await her terrible fate. The monster was about to seize her when *Perseus* arrived, slew the beast, unchained the maiden, and carried her away with him on the winged horse *Pegasus*. Of course the two were afterward happily wedded, and after their deaths given a place in the heavens with the famous horse.

There are no very brilliant stars in these constellations but each is recognized easily by a characteristic group of bright stars. Four in *Pegasus* make nearly a square, a very large one. The northeastern star in the Great Square of

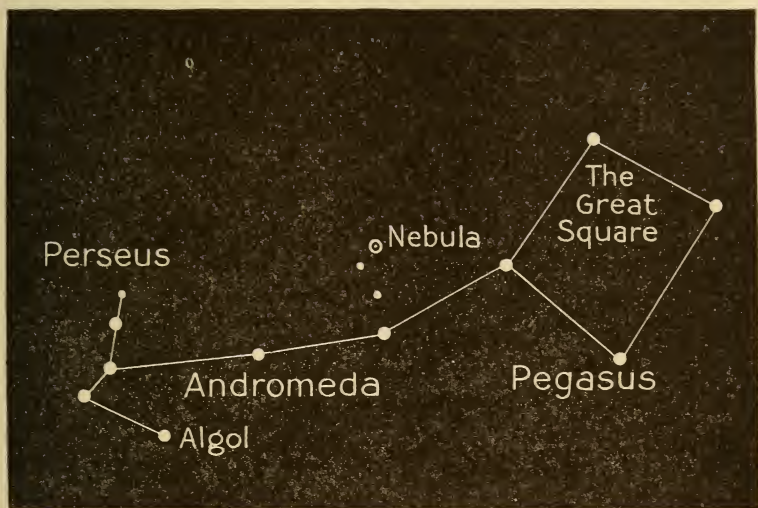
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Pegasus is also in *Andromeda*. Two bright ones in line with this are also in *Andromeda*. These two with the Square make a group resembling a Dipper with a bowl much larger than that of the Big Dipper. In line with the row of stars in *Andromeda*, is a bright star in a curving line of stars known as the "Segment" in *Perseus*. This row forms an L-shaped figure with a star at one side.

This last star, *Algol*, is especially interesting. Every two and three-quarters days, it becomes dim, remains dim for about three and one-half hours and then brightens again, repeating the process regularly. A dark star moving around *Algol* and partly eclipsing it has been found to be the cause of this change. Ordinarily *Algol* is a bright star, and compares favorably with the brightest star in the Segment, but at its dimmest, it is noticeably less bright and would be classified by anyone as a faint star.

It is worth while to look at the stars in the Segment with an opera glass. The Milky Way goes through *Perseus*, and consequently the opera glass reveals many beautiful groups of stars not visible without a glass. Those near the brightest star of the Segment are particularly lovely. The opera glass will also help in finding the Great Nebula in *Andromeda*, although it can be found with the unaided eye.

The Great Square of *Pegasus*, followed by *Andromeda* and *Perseus*, can be seen at nine o'clock by the first of August, but it is not until the fall that the three constellations are high enough to be seen to the best advantage.



PEGASUS, THE WINGED HORSE; ANDROMEDA, THE CHAINED MAIDEN; PERSEUS, THE CHAMPION.

Look for these between August 15, and February 15.

August 15, 9 p.m. low in the east and northeast.

October 1, 9 p.m. *Pegasus* high in the southeast,
Perseus low in the northeast, *Andromeda* between.

January 1, 9 p.m. *Perseus* overhead, *Pegasus* low in the west.

Chart 11

SECTION XI

URSA MAJOR, THE GREAT BEAR; URSA MINOR, THE LITTLE BEAR; CASSIOPEIA, THE QUEEN; DRACO, THE DRAGON

If utter darkness closed the day my son—
But earth's dark forehead flings athwart the heavens
Her shadow crown'd with stars—and yonder—out
To northward—some that never set, but pass
From sight and night to lose themselves in day.
—TENNYSON: "The Ancient Sage."

The seven stars to light you
Or the polar ray to right you.
—KEATS: "Robin Hood."

The Big Dipper in *Ursa Major*, is without doubt the best known star-figure in the heavens. It can be seen at any time of night all through the year in the latitude of New York or further north. Every camper needs to know this Dipper because it will always tell him what direction is north. The two stars at the end of the bowl furthest from the handle point unfaillingly to the North Star. Facing this star, the camper knows that he is facing north, his right hand extended points east, his left hand, west. A keen eye soon discovers that the North Star is not exactly in line with the pointers, but it is the only bright star in that direction, and no one ever has the least difficulty in finding it if he has first found the pointers. It is thrilling to think of all the travelers of different races who have throughout the centuries of human history gazed upon this Dipper and found their way by its guidance. Greek sailors and Indian tribes, and our own fugitive slaves, have known how to find north by the stars.

URSA MAJOR; URSA MINOR; CASSIOPEIA; DRACO

Six of the stars of the Big Dipper are about equally bright, ranking among the stars second in brightness to the twenty brightest; but the one joining the bowl with the handle spoils the perfection of the group as it is distinctly less bright. It is considered by some a test of a good eye to see a faint star, *Alcor*, near the star, *Mizar*, at the bend of the handle. It is not much of a test however, as average eyes can easily see it. These two stars are known as the Horse and the Rider.

Although the Big Dipper is generally well known, few know the Little Dipper in *Ursa Minor*. The North Star, *Polaris* or Pole Star, is at the end of the handle. Two bright stars in a line parallel to a line joining the second and third in the handle of the Big Dipper are in the bowl of the Little Dipper. These are known as the guardians of the Pole. When these are found, it is easy to finish the figure. Two faint ones complete the bowl and two other faint ones connect the bowl with the North Star at the end of the handle. The Little Dipper hangs from the North Star and is always turned just the opposite way from the Big Dipper.

On the other side of the North Star from the Big Dipper is a zig-zag row of bright stars shaped like a large W. These are in *Cassiopeia*. At 9 p.m., May 1, the Big Dipper is almost overhead and the W of *Cassiopeia* is very low near the northern horizon. During the summer, the Big Dipper is found at the same hour, lower towards the northwest, handle up, at the left of the North Star and the W on the other side at the right.

Between the two Dippers winds the Dragon, *Draco*. His head is easily recognized by two bright stars, which form with two faint ones near, a conspicuous four-sided group. It

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is always between *Vega* and the bowl of the Little Dipper. One foot of *Hercules* rests on the head of the Dragon.

These constellations are in the sky in the day as well as at night, although invisible in the diffused sunlight. As Tennyson says, they never set but "pass from sight and night to lose themselves in day." Other constellations set. The camper will enjoy watching the sky, one of the nights when he is sleeping in the open, to prove the poet correct. Perhaps he will give himself the task of discovering why some constellations never set in our sky and just what is meant by "our sky". How is it further north? And what is the sky like further south, in South Africa for instance? Why should it be different? The first men to discover that the southern skies are different from our northern ones came back with marvellous stories of the strange new heavens they had seen: the Southern Cross, the brilliant *Canopus*, and the beautiful *Clouds of Magellan*. But it is beyond the scope of this pamphlet to describe the wonders of the southern firmament, or to explain the behavior of the sky when we travel. We must leave that for the long winter evenings when books by the fireside rival the attractions of the cold out-of-doors.



URSA MAJOR, THE BIG BEAR; URSA MINOR, THE LITTLE BEAR;
CASSIOPEIA, THE QUEEN; DRACO, THE DRAGON.

These are visible all the year in the latitude of New York or further north.

May 1, 9 p.m. *Ursa Major* almost overhead, bowl of Big Dipper opening downwards; bowl of Little Dipper in *Ursa Minor* at the right of the North Star; *Cassiopeia* low in the north; head of *Draco* in the northeast.

(Continued on next Page)

Chart 12

July 1, 9 p.m. *Ursa Major* high in the northwest, handle of Big Dipper up; bowl of Little Dipper above the North Star; head of *Draco* nearly overhead; *Cassiopeia*, low a little east of north.

September 1, 9 p.m. *Ursa Major* low in the northwest; bowl of Little Dipper at left of North Star; *Cassiopeia* at right of North Star; head of *Draco* above bowl of Little Dipper.

Chart 12



URSA MAJOR, THE GREAT BEAR.

Showing how the Big Dipper fits into the form of the Great Bear.

Chart 13

SECTION XII

THE STARS THE NIGHT THROUGH

The stars of midnight shall be dear
To her

—WORDSWORTH.

“You are different afterwards”, explains a camper who has been called upon to defend the growing fashion of sleeping in the open. “It’s not the same inside a tent. No, perhaps we don’t sleep much, not the first night anyway, but we rest. There’s nothing that rests one quite so much as just lying on the pine needles and watching the stars. No, we don’t talk much. There’s something about it that makes one want to be quiet. I often sleep out alone back of my tent. Afraid? Oh no. There’s nothing to be afraid of. You will like being alone after you have tried it. The stars will keep you company. There’s a red one I watch in the west until it’s gone down back of the pines. It’s lovely glowing through the pine needles. A very bright one overhead flashes colors like a diamond. The other is more like an opal.” Lucky campers who have discovered that there are ways to rest without sleep, and that solitude does not mean loneliness!

The star overhead at nine o’clock in early August that “flashes color like a diamond,” is *Vega*, and the red one high in the west is *Arcturus*. Between them is the splendid Northern Crown. East of *Vega* is the Great Cross and lower, just above the northeastern horizon, is the Great Square of *Pega-*

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sus. *Antares* glows deep red in the southwest, in the Scorpion, and the Archer follows in the south with his bow and arrow. Above the Archer, just below the foot of the Cross is *Altair* easily recognized by the faint star on each side. The Big Dipper is west of north, bowl down, handle up, and the Great W in *Cassiopeia* is low on the opposite side of the North Star from the Big Dipper.

If the camper notices where these star-figures are in reference to objects on the horizon, he will soon make a great discovery. He will see the whole sky is apparently moving, carrying the western stars below the horizon and bringing up new ones in the east all night. It is a thrilling experience to watch the sky a night through. By eleven *Arcturus* is near the northwestern horizon and *Antares* is already setting. A bright star has appeared in the southeast, the "Lone Star," *Fomalhaut*, so called because there are no conspicuous stars near. *Fomalhaut* is one of the sailors' stars for it shows the way to the south. Serviss describes it as a "distant watch-fire gleaming in the midst of a lonely prairie." Beyond *Pegasus*, *Andromeda* has risen with its famous nebula, and *Perseus* is following low in the northeast. It will soon be noticed that the Dippers are not setting. The Big Dipper is swinging around the North Star and is now nearer the northern horizon while the W of *Cassiopeia* is higher than it was at nine o'clock on the other side of the North Star. There is evidently room for the Dippers to make their circuit without going below the horizon.

If the night is moonless and therefore dark, as well as clear, the Milky Way adds greatly to the splendor of the scene. The irregularity of this luminous stream of stars is a part of its beauty. The camper should look at different regions

THE STARS THE NIGHT THROUGH

in it with his opera-glass. There is a beautiful double star-cluster half-way between *Perseus* and *Cassiopeia*. Any bright star is still more beautiful through the opera glass, and the winding rows and groups formed by faint stars not visible without the glass are fascinating.

By one o'clock in the morning *Arcturus* has gone, and the great Goat Star, *Capella*, has appeared in the northeast beyond *Perseus*. By three the stars of winter are coming into view although it is only midsummer. The red *Aldebaran* in the eye of *Taurus*, the Bull, has risen in the east with the beautiful star-cluster, the *Pleiades*. The camper will want to test his eyesight on the *Pleiades*. Good eyes see six and exceptional eyes see many more. This group should also be examined with an opera-glass. Soon *Orion*, the most characteristic of winter constellations, has followed *Taurus* above the eastern horizon, with the Heavenly Twins further north. If the ambitious observer, who has begun to get acquainted with the stars in summer, cannot wait until winter has brought other stars into view, he has only to camp out one night, and watch the sky turn, bringing up towards morning all the stars that will make the sky brilliant in December and January in the early evening.

Is the sky really turning? So people naturally thought, when they began to think about it at all. The sky was called the Celestial Sphere, on the inner surface of which all the heavenly bodies seem to be situated. By its daily motion, it was supposed to carry every heavenly body—sun, moon, stars and all—around the earth every twenty-four hours. But the fact that the nearest star is more than 25 millions of millions of miles from us, and that other stars are inconceivably further off than this, means that the stars would

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have to travel at impossible speeds to get around and back in place in twenty-four hours. Moreover the more distant ones would have to travel faster to get back in the same relative positions with the others. It becomes therefore more easy to believe that the millions of stars are not moving around the earth at all, but that it is our own little earth which by its rotation causes the celestial sphere to seem to turn carrying the stars across from east to west as we watch through the night, and bringing up, in due time, the sun.

Still it is difficult to believe that this earth which seems so big and solid can really be moving. Thoughtful people were not ready to believe it when Copernicus, a Polish astronomer, suggested it in the middle of the sixteenth century, or later, in the next century, when Galileo, an Italian,* presented convincing arguments to prove that the earth does indeed move. Shortly after the end of Galileo's life, however the fact of the earth's rotation was established.

Steadily, noiselessly, whether we sleep or wake, the earth turns round, holding us firmly with its powerful gravitation, quite unaware of what is happening, unless perchance we are watching the sky as we are this August night.

*Read the fascinating account of the life of Galileo in *Pioneers of Science* by Sir Oliver Lodge.

SECTION XIII

TELLING TIME BY THE STARS

He whose roof is heaven, who has no other cover, over whom the stars continually rise and set in one and the same course, makes the beginnings of his affairs and his knowledge of time depend upon them.

—AL BIRUNI, 1000 A.D.

The camper who has made heaven his roof discovers that it is an easy matter to tell the time of night by means of the stars. If it is mid-summer, he knows that at nine o'clock, the Big Dipper is west of the North Star, handle up and bowl down, with the Pointers almost directly at the left of the North Star. As the hours pass, it swings around, until at three o'clock in the morning, it is under the North Star, low, just above the horizon. He knows that it completes its circuit in the daytime, and will be back the next night, west of the North Star again. If he wants to know the hour any-time during the night, he must imagine the great circle through which one of the Pointers swings. In six hours, the star moves through one-quarter of the whole circle. So if he remembers where the star was at nine o'clock he can easily tell from its position how many hours have passed since. He will notice two great differences between the star clock and our house clocks. It takes the hour hand of the star clock twenty-four hours instead of twelve to go around, and it goes in the opposite direction.

Any star-figure can be used. Is the Northern Cross overhead? It is about eleven. Is the belt of *Orion* above

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the eastern horizon? It is three in the morning. With a little practice, one becomes quite an expert.

After a few weeks however, the time-piece has changed. At nine o'clock, the Pointers are not at the left of the North Star but lower, and the Cross is overhead earlier in the evening. In November, the Big Dipper is underneath the North Star at nine. In February at the right, handle down, and in May high above. But each night it moves about the North Star and is back in twenty-four hours in nearly the same position as the night before. The fact that it is steadily gaining time does not become noticeable, without very careful observations, for several nights. Therefore, if we are familiar with the position of the Dipper at one hour every night, we can tell the time from its position later throughout that night. For example, if the month is May, and awakening in the night, I notice that the Pointers are at the left of the North Star, I know that it is about three o'clock, for at nine they are above the North Star, and since they have moved one-quarter of the entire way around, six hours have elapsed.

If we are not using the Big Dipper it is important to know that every night, a given constellation rises about four minutes earlier than the night before, and hence in a month it is rising two hours earlier. The sky August 1 at 9 p.m. is the same as the sky September 1 at 7 p.m. The sky August 1 at 3 a.m. is the same as the sky December 1 at 7 p.m. or January 1 at 5 p.m. Anyone who is familiar with the constellations therefore, knows the time of night when he sees which are rising. If on the first of October, I see the Sickle of *Leo* in the northeast, I know that it is about three o'clock. If the Sickle has not risen, but *Orion* is appearing in the east, it is

TELLING TIME BY THE STARS

only eleven. If *Orion* is fairly high, and the Dog Stars just rising, it is one o'clock. In the spring, it will be the stars of summer that can be seen rising as the night passes. Many a sleepless person has found rest watching the silent procession of stars through the night.

"One has a fine sense of companionship with the stars when he has secured this kind of acquaintance with them—when on looking out of the window at any hour of the night, he can see a familiar face twinkling as if in friendly recognition of the fact that he must know it is due at that hour and is expecting to see it," writes Martha Evans Martin in *The Friendly Stars*.

But why do we not see the same stars every evening, summer and winter? Naturally this question was asked and answered although incorrectly, early in human history. If we watch the sky carefully for a few months, we shall see what is happening.

Let us begin in August. Then *Scorpius* is conspicuous in the south. Week by week, we find it further west at the same hour, until by November it is lost in the sunlight. The sun is in *Scorpius*, we would say, and that is why the stars of *Scorpius* cannot be seen. They are in the sky in the daytime, but the bright sunlight hides them and they set with the sun. If there should be an eclipse of the sun, we should see them near the sun. Continuing to watch in the same way, we find *Sagittarius* following *Scorpius*, until by December, the sun has entered *Sagittarius* and the *Sagittarius* stars can no longer be seen. Thus we should discover that the sun apparently travels around the earth once a year. We cannot see the constellation it is in, although it is in the sky

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all day, but at night we see rising whatever constellation is in the opposite part of the heavens. As *Scorpius* sets with the sun in November, *Taurus*, the Bull, begins to appear in the northeast. When we say "the sun enters a constellation," we must remember that the sun is really very much nearer us than the stars, and therefore "enters" a constellation only in the sense of being seen in the same part of the sky as that constellation. The constellations from the background against which the sun is seen, apparently passing from one to the other. We shall see presently that the sun does not really move around the earth, but it was quite naturally supposed to do so by those early observers who first tried to explain the behavior of the stars.

The part of the sky apparently traversed by the sun during the year was divided into twelve constellations, one for each month. Great importance was attached to these constellations, for not only the sun, but the moon and the planets are always found in them. A little rhyme makes it easy to remember at least their English names.

The Ram, the Bull, the Heavenly Twins,
And next the Crab, the Lion shines,
The Virgin and the Scales,
The Scorpion, Archer, and He-Goat,
The Man that bears the watering pot,
And Fish with glittering tails.

One who has been observing the sky through the spring and summer knows at least six of these. Since most of these constellations are animals, they are known as the constellations of the Zodiac (Zo meaning animal). The Zodiac is the belt of the sky in which the planets are always found. Old mythological figures and signs are often used in designs of

TELLING TIME BY THE STARS

the Zodiac in almanacs, diaries, etc. One such design may be seen on the floor of the Boston Public Library, near the entrance. It is interesting to pick out the Lion, the Heavenly Twins, and all the famous twelve characters.

However, the sun does not revolve around the earth from one constellation to another, as it appears to do. At the same time that the twenty-four hour apparent motion of the stars around the earth was proved to be due to the rotation of the earth on its axis, the yearly procession of the stars was proved to be due to the revolution of the earth about the sun. How this makes the sun seem to move around the earth, and different stars come into the evening sky from night to night, can easily be shown by a little experiment. Let a circle of people represent stars. Near the center of the circle, put a lamp for the sun. Let a girl representing the earth walk around this lamp, stopping occasionally to notice what stars she sees at night. In one position, she cannot see the stars back of the lamp, for the lamp hides them. If it is November these are the stars of *Scorpius*. But as she turns her back on the lamp (rotates) it is night, and she can see the stars in the opposite part of the circle, the *Taurus* stars. As she revolves around the sun, she sees the sun among different stars, hiding them, and at night she sees new stars. When she is half way round the sun, the sun is in *Taurus*, hiding those stars, and *Scorpius* opposite is seen at night. The stars in the direction of the earth's axis, in the ceiling in our illustration, are visible all the year. Thus it becomes clear that the motion of the earth about the sun explains why the constellations visible in the evening are different in different seasons.*

* See Sir Robert Ball's *Starland*, pp. 58-71, for further discussion of this topic.

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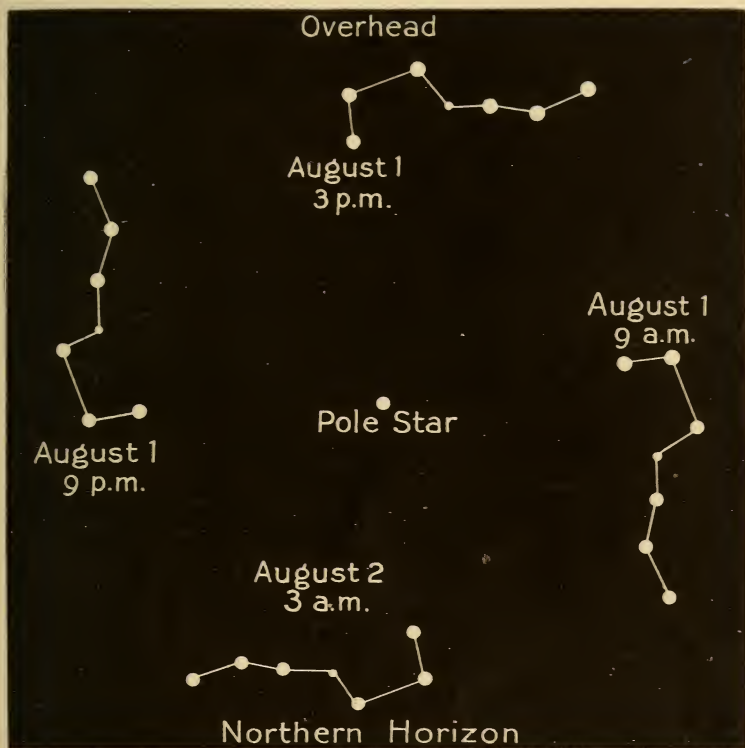
One who has made friendship with the stars one year is always happy as the seasons pass when he sees his old friends coming back to the sky. He welcomes them just as joyously as he does the bluebird in March and the violets in April. They are even more certain to come with the season for the bluebird may be driven to another home and the violets may be uprooted, but no man can rob the sky of its splendors. The laws governing its behavior are independent of human events and of human will.

With what exact obedience you move,
Now beneath, and now above;
And, in your vast progressions, overlook
The darkest night and closest nook!

Some nights I see you in the gladsome East,
Some others near the West;
And when I cannot see, yet do you shine,
And beat about your endless line.

Settle and fix our hearts, that we may move,
In order, peace, and love,
And, taught obedience by thy whole creation,
Become an humble, holy nation!

—HENRY VAUGHAN: "The Constellation."



Showing four different positions of the Big Dipper during twenty-four hours.

Chart 14



Showing four different positions of the Big Dipper
at the same hour, during the year.

Chart 15

SECTION XIV

THE TWENTY BRIGHTEST STARS ARRANGED IN ORDER OF BRIGHTNESS

Name of Star	Constellation	Best Seen
1 <i>Sirius</i>	<i>Canis Major</i> , The Greater Dog	Winter
2 <i>Canopus</i>	<i>Carina</i> , Keel of Ship	Seen only in latitudes south of 37°
3 <i>Alpha of Cen- taurus</i>	<i>Centaurus</i> , The Centaur	Seen only in latitude south of 30°
4 <i>Vega</i>	<i>Lyra</i> , The Lyre	Summer and fall
5 <i>Capella</i>	<i>Auriga</i> , The Charioteer	Winter
6 <i>Arcturus</i>	<i>Boötes</i> , The Herdsman	Summer
7 <i>Rigel</i>	<i>Orion</i> , The Giant Hunter	Winter
8 <i>Procyon</i>	<i>Canis Minor</i> , The Lesser Dog	Winter
9 <i>Achernar</i>	<i>Eridanis</i> , The River Po	Seen only in latitudes south of 32°
10 <i>Beta of Cen- taurus</i>	<i>Centaurus</i> , The Centaur	Seen only in latitudes south of 30°
11 <i>Altair</i>	<i>Aquila</i> , The Eagle	Summer and fall
12 <i>Betelgeuze</i>	<i>Orion</i> , The Giant Hunter	Winter
13 <i>Alpha of Crux</i>	<i>Crux</i> , The Cross	Visible only in latitudes south of 28°
14 <i>Aldebaran</i>	<i>Taurus</i> , The Bull	Winter
15 <i>Pollux</i>	<i>Gemini</i> , The Twins	Winter and Spring
16 <i>Spica</i>	<i>Virgo</i> , The Virgin	Spring
17 <i>Antares</i>	<i>Scorpius</i> , The Scorpion	Summer
18 <i>Fomalhaut</i>	<i>Piscis Australis</i> , The Southern Fish	Fall
19 <i>Deneb</i>	<i>Cygnus</i> , The Swan	Summer and Fall
20 <i>Regulus</i>	<i>Leo</i> , The Lion	Spring

SECTION XV

PRONUNCIATION

Constellations	Stars
<i>Vir'-go</i>	<i>Spī'-ca</i>
<i>Bō-ō'-tes</i>	<i>Arc-tū'-rus</i>
<i>Cō-rō'-na</i>	<i>Gem-ma</i>
<i>Her'-cū-lēs</i>	
<i>Cō'-ma Bēr-ē-nī'-ces</i>	
<i>Lē'-o</i>	<i>Rēg'-ū-lūs</i>
<i>Au-rī'-ga</i>	<i>Ca-pel'-la</i>
<i>Gēm'-i-ni</i>	<i>Cas'-tor and Pōl'-lūx</i>
<i>Scor'p-i-us</i>	<i>Ant-ā'-rēs</i>
<i>Sa-git-tā'-rius</i>	
<i>Cyg'-nus</i>	<i>Dēn'-eb</i>
<i>Lȳ-ra</i>	<i>Vē'-ga</i>
<i>Á-quil-a</i>	<i>Al-tair</i>
<i>Del-phī'-nus</i>	
<i>Per'-se-us</i>	<i>Al-gol</i>
<i>An-drōm'-e-da</i>	
<i>Pēg'-a-sus</i>	
<i>Ur'-sa Mā'-jor</i>	
<i>Ur'-sa Mī'-nor</i>	<i>Pō-la'-ris</i>
<i>Drā'-co</i>	
<i>Cas-sio-pē'-ia</i>	
<i>Tau'-rus</i>	<i>Al-dēb'-a-ran</i>
	<i>Plei'-a-des</i>
<i>Pis'-cis Aus-tra'-lis</i>	<i>Fō-mal-haut</i>
<i>O-rī'on</i>	<i>Rī'-gel</i>
	<i>Be-tel'-geuze</i>
<i>Cā'-nis Mā'-jor</i>	<i>Si'-ri'-us</i>
<i>Cā'-nis Mī'-nor</i>	<i>Prō'-cy-on</i>

SECTION XVI

FOR FURTHER OBSERVATIONS

- "A Beginner's Star - Book." Kelvin McKready. G. P. Putnam's Sons.
- "A Field Book of the Stars." William T. Olcott. G. P. Putnam's Sons.
- "Astronomy with the Naked Eye." Garrett P. Serviss. Harper Brothers.
- "Starland." Sir Robert Ball. Ginn & Company.
- "The Monthly Evening Sky Map." Leon Barritt. 150 Nassau St., New York City.
- "A Trip to the Moon." Pamphlet. Louise Brown. The Womans Press, 600 Lexington Ave., New York.
- "The Sky: Winter Nights." Pamphlet. Louise Brown. The Womans Press, 600 Lexington Ave., New York.
- "All Night with the Stars." Pamphlet. Louise Brown. The Womans Press, 600 Lexington Ave., New York.

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